APPENDIX C.6
Civil Engineering

General. The purpose of civil engineering is to support the development of quantity estimates to be used in calculating the cost estimate for the NER plan. Carter & Burgess generated some of the quantity estimates. The plan consists of various structures including rock riffles, inverted "T's", embayments, trib mouths, invert slope protection, modifying the existing pilot channel and existing side slopes, and existing sheet pile weirs, and hydraulic outfalls, removing concrete pilot channels and concrete rubble, and restoring remnants. Roads, walkways, and utilities will be relocated because of the enlarged pilot channel and laid back slopes.

Rock Riffles. 29 rock riffle structures will be created by a concrete weir with rock sloping on 1V:30H on either side of the structure until the slope meets the proposed grade of the pilot channel (See sheets C.6-2 through C-6-4). Also, the existing San Juan dam will be modified to create a rock riffle by removing concrete from the top of the existing structure (See sheet C.6-5).

Inverted "T" Structures. Two structures will be built for primarily ponding water upstream of the structures. Riprap will be placed on a 1V:4H slope on the upstream side until it matches the proposed grade line. Riprap will also be placed 50 feet downstream of the structure to protect against erosion (See sheet C.6-6).

Embayments. Nine embayments will be constructed ponds on either side of the pilot channel and be supplied with runoff from the side drainage and overflow from the pilot channel. These ponds will be approximately two feet in depth and protected with riprap on the upstream and downstream ends (See sheet C.6-7).

Trib Mouths. Four trib mouths will be constructed where major side drainage tributaries come into the San Antonio River. The average depth of these ponds will be over 1 foot deep and be protected by riprap around the edges (See sheet C.6-8).

Invert Slope Protection. Three separate areas where the slope of the San Antonio River drops significantly in a short reach will be protected with riprap that is placed on base material.

Pilot Channel and Existing Side Slopes. The existing pilot channel will be enlarged and the side slopes of the flood control channel will be flattened where the favorable conditions exist. A base flow channel will be constructed within the pilot channel for minimal flows. The selected disposal site for the excess material will be south of I-410 and east of the proposed project. Carter and Burgess generated quantities for excavation, fill, and spoil. (See C.6-1 for typical sections).

Existing Sheet Piles. The 11 existing steel sheet piles weirs will be cut to match the new proposed grades of the pilot channel and base channel.

Outfall Modifications. These 85 modifications will include existing chute outfalls, pipe outfalls, and box culverts. These modifications are due to the enlarged pilot channel providing greater conveyance for vegetation (See sheet C.6-10).

Removing Concrete Pilot Channels. The existing pilot channel is concrete in several areas. This concrete will be removed and disposed of in a proper manner. In addition, the concrete remains of old San Juan dam will be removed from the project.

Remnants. Two remnants will be restored where the old river channel was covered with fill from the original project. One remnant is located just upstream of Ashley Road and the other one will be located just downstream of I-410 (See sheet C.6-9).

Relocation of Roads, Walkways, and Utilities. Mission Parkway, existing walkways, and utilities will be relocated because of the excavation of the pilot channel and the laying back of slopes. The quantities for utility relocations were taken from Carter & Burgess estimated quantities (See sheet C.6-11).

Recreation. A recreation plan was developed by CESWF based upon the plans developed by Carter Burgess. A total of 56,840 linear feet of new 10-feet wide concrete walkways will be provided for transversing this corridor. Five comfort stations (group shelters) will provide resting areas along the trail. Three footbridges (crossovers) will provide access from one side of the San Antonio River to the other side. One minor bridge will cross the remnant just downstream of I-410.

Structural Engineering

General. The purpose of structural engineering is to support the development of quantity estimates to be used in calculating the cost estimate for the NER plan. The plan consists of various structures including rock riffles, inverted “T’s”, embayments, trib mouths, invert slope protection, modifying the existing pilot channel and existing side slopes, and existing sheet pile weirs, and hydraulic outfalls, removing concrete pilot channels and concrete rubble, and restoring remnants that are described in the Civil Engineering Appendix C.6.

Description of Proposed Structures

East Southcross Boulevard. The bridge is an existing bridge that needs to have the water conveyance area increased. The method of increasing the area is to install an inverted "Tee", standard retaining wall under the bridge.

- The bridge will be out of service during the time the Contractor is working on the bridge.

- The approach roadway slab and the material beneath the approach roadway will be removed and replaced after the channel work is complete.

East White Avenue. The bridge is an existing bridge that needs to have the water conveyance area increased. The method of increasing the area is to install an inverted "Tee", standard retaining wall under the bridge.

- The bridge will be out of service during the time the Contractor is working on the bridge.

- The approach roadway slab and the material beneath the approach roadway will be removed and replaced after the channel work is complete

Recreation Bridges Across the San Antonio River. Four recreation footbridges have been proposed for the Mission Reach of the San Antonio River. Because of the forces developed during a flood event, it was decided that the widest Texas Department of Transportation box culverts should be used for each bridge. The widths and the heights provide the required opening for the bridge and provide the culvert openings required for hydraulic conveyance. The bridge locations are as follows:

- Mission Espada Restored Remnant Footbridge at River Station 1732+00 would be a 2-span, 10-feet wide by 5-feet high culvert should be used.

- Footbridge Upstream of San Juan Dam at River Station 1914+00 would be a 6-span , a 4-span, and a 3-span, 10-feet wide by 10-feet high culvert should be us

- Footbridge Downstream of East White Avenue at River Station 1924+00 would be a 6-span and a 4-span, 10-feet by 8-feet high culvert should be used.

- Footbridge Upstream of San Pedro Creek at River Station 2062+50 would be2 2-span, 10-feet wide by 7-feet high culvert should be used.

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Design Criteria References. Allowable stresses, loading conditions, design assumptions and other criteria were based on applicable parts of the following references unless otherwise noted.

- Engineering and Design; Strength Design for Reinforced Concrete Structures, EM 1110-2-2104, 30 June 1992.

- Building Code Requirements for Reinforced Concrete, ACI 318-02.

- Engineering and Design; Retaining and Flood Walls, EM 1110-2-2502, 29 September 1989.

- Engineering and Design; Retaining and Flood Walls, ETL 1110-2-322, 15 October 1990

- Engineering and Design; Structural Design of Concrete Lined Flood Control Channels, EM 1110-2-2007, 30 April 1995

- **American Association of State Highway and Transportation Officials – Standard** Specifications for Highway Bridges

Geotechnical Data for Structures. The proposed bridge structures should be supported on the foundation recommended by the Geotechnical Section after tests of the soil have been made

DESIGN DATA

a. Unit Loads

Concrete	150 PCF
Water	62.5 PCF

b. Reinforced Concrete Properties

Concrete	f 'c = 3000 PSI 3600 psi (bridge abutments) 4000 psi (bridge slabs)
Reinforcing Steel	fy = 60000 PSI

c. Uplift

Hydrostatic uplift pressure is assumed to act over 100 % of the base of the structures. The drainage system is assumed to be effective in reducing the hydrostatic head by 50%.

d. Bridge Design Loads

1. Vehicular bridges will be designed for an HS 20-44 live load in accordance with AASHTO.

2. Pedestrian bridges will be designed for 85-psf live load in accordance with ASHTO and an H-20 truck.